STATE of UTAH

ADMINISTRATIVE RULES for WATER WELL DRILLERS

Adopted July 15, 1987

STATE of UTAH

DIVISION of WATER RIGHTS

ROBERT L. MORGAN

State Engineer

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PART I

ADMINISTRATIVE RULES FOR WATER WELL DRILLERS

1 PURPOSE

These "Rules" are promulgated pursuant to Section 73-3-25 of the Utah Code Annotated 1953, as amended. The purpose of these rules is to assist in the orderly development of underground water, insure that minimum construction standards are achieved in the drilling and repairing of water wells, prevent pollution of aquifers within the state, prevent wasting of flowing wells, obtain accurate records of well drilling operations, and insure compliance with the state engineer's authority for appropriating water.

1.1 Construction standards outlined in this document are meant to serve as guidelines for minimum acceptable standards. In some cases more stringent standards would be called for if compliance with these standards would not result in a well which is free from pollution, or would be a source of subsurface leakage, or would result in contamination of the groundwater supply.

1.2 It is not intended that these rules govern the drilling of geothermal wells. Anyone contemplating drilling of geothermal wells is subject to Title 73 Chapter 22 of the Utah Code Annotated 1953 and the rules promulgated pursuant to that section. The State Engineer's Office can be contacted for information regarding drilling of geothermal wells.

1.3 It is not intended that the following rules govern the drilling of temporary exploratory holes that are drilled to obtain information on the subsurface strata on which an embankment or foundation is to be placed, or an area proposed to be used as a potential source of material for construction.

1.4 In order to provide for protection of the water resources of the state and obtain valuable information on the aquifers of the state, Section 73-3-22 Utah Code Annotated 1953 and the "Rules" have been amended to include the drilling of water monitoring wells.

1.5 Wells constructed to monitor man-made structures, house instrumentation to monitor structural performance, or dissipate hydraulic pressures on structures are exempt from the following rules, provided that the wells do not interfere with established acquifers, or their primary purpose is not for monitoring water quality.

1.6 Public water supply wells are subject to additional requirements established by the Utah Safe Drinking Water Committee, pursuant to their authority under Title 26 Chapter 12 of the Utah Code Annotated 1953. The Utah Bureau of Drinking Water/Sanitation may be contacted for additional information regarding public water supply wells. Generally, plans and specifications for a public supply well must be reviewed and approved by the Bureau before the well is drilled.

2 DEFINITIONS

2.1 ABANDONED WELL--a well whose purpose and use have been permanently discontinued or a well that is in such a state of disrepair that its purpose cannot be reasonably achieved.

2.2 ANNULAR SPACE--the space between the inner well casing and the outer well casing or borehole.

2.3 AQUIFER--a porous underground formation yielding usable amounts of water.

2.4 ARTESIAN AQUIFER--a water-bearing formation which contains underground water under sufficient pressure to rise above the zone of saturation.

2.5 ARTESIAN WELL--a well where the water level rises appreciably above the zone of saturation.

2.6 BENTONITE--a highly plastic, highly absorbent, colloidal clay composed largely of mineral montmorillonite.

2.7 CASING--a tubular retaining structure that is installed in the borehole to maintain the well opening.

2.8 CONSOLIDATED FORMATION--bedrock consisting of sedimentary, igneous, or metamorphic rock. A consolidated impermeable formation shall have sufficient thickness to form a geologic barrier in the vicinity of the well in order to be incorporated in the surface seal of a well.

2.9 DRAWDOWN--the difference in elevation between the static and pumping water levels.

2.10 GRAVEL-PACKED WELL--a well in which filter material is placed in the annular space to increase the effective diameter of the well and to prevent fine-grained sediments from entering the well.

2.11 GROUT--a fluid mixture of portland cement and water of a consistency that can be forced through a pipe and placed as required. Various additives, such as sand, bentonite, and hydrated lime, may be added.

2.12 MONITOR WELL--A "well" (as defined in 2.24) which is constructed for the purpose of determining water levels and/or monitoring chemical, bacteriological or other physical properties of groundwater or vadose zone water.

2.13 NEAT CEMENT GROUT--cement conforming to ASTM Standard C150, with no more than six gallons of water per sack of cement.

2.14 OPERATOR--a drilling-machine operator is an individual who is employed by a driller holding a current Utah Well Driller's license for the purpose of constructing water wells with equipment owned by the licensee.

2.15 PUBLIC SUPPLY WELL--a well, either publicly or privately owned, providing water for human consumption and other domestic uses which has at least 15 service connections or regularly serves an average of at least 25 individuals daily for at least 60 days out of the year.

2.16 PUDDLING CLAY--a mixture of bentonite, other expansive clays, or fine-grained material and water, in a ratio of not less than 7 pounds of bentonite or expansive clay per gallon of water.

2.17 STATE ENGINEER--state engineer means the Director of the Utah Division of Water Rights or any employee of the Division of Water Rights designated by the state engineer to act in administering these rules.

2.18 STATIC LEVEL--stabilized water level in a nonpumped well beyond the area of influence of any pumping well.

2.19 TEST WELL--a well completed to obtain information on groundwater quality, quantity, and geologic conditions.

2.20 TREMIE PIPE--a device that carries materials to a designated depth in a drill hole.

2.21 UNCONSOLIDATED FORMATION--loose, soft, incoherent rock-material composed of sedimentary, igneous, or metamorphic rock which includes sand, gravel, and mixtures of sand and gravel.

2.22 VADOSE ZONE--the zone containing water under less than atmospheric pressure, including soil water, intermediate vadose water and capillary water. The zone extends from land surface to the water table.

2.23 VALID AUTHORIZATION TO DRILL--shall consist of any of the following:

a) An approved application to appropriate.
b) An approved "rush letter".
c) An approved permanent change application.
d) An approved exchange application.
e) An approved temporary change application.
f) An approved application to renovate or replace.
g) An approved "test well letter".
h) An approved "monitor well letter".
i) Any letter or document from the state engineer directing or authorizing work to be done on a well.

Most of the above expire after predetermined periods of time. Items a) through f), inclusive, allow the applicant to contract with a well driller to drill or renovate exactly one well at each point of diversion listed on the approved form. When the work contemplated is completed or abandoned, the permission to drill terminates. An approved test well or monitor well letter is a special case permitting exploratory drilling but allowing only enough water to be diverted from the approved points to determine the characteristics of the groundwater source.

2.24 WELL--a horizontal or vertical excavation or opening into the ground made by digging, boring, drilling, jetting, or driving or any other artificial method for utilizing or monitoring underground waters.

2.25 WELL DRILLER--any person duly licensed by the state engineer that constructs a well for compensation or otherwise.

2.26 WELL DRILLING--the act of constructing, repairing, or deepening a well, including all incidental work.

3 WELL DRILLER'S LICENSES

3.1 GENERAL. State law requires every person that constructs a well in Utah to obtain an annual well driller's license from the state engineer and to file with him a bond in the penal sum of $5000 (Payable to the Office of the State Engineer) conditioned upon proper compliance with the law and rules for well drillers. Applications for well driller's licenses shall be made on forms furnished by the state engineer. All licenses expire on the 31st day of December following their issuance and are not transferable.

3.2 APPLICATION FOR LICENSE. Before a Utah well driller's license will be issued, the applicant must do all of the following:

3.2.1 Make application to the state engineer on forms provided for that purpose, including documentation of prior well drilling experience.

3.2.2 Pay an application fee of $45.00. (Annual renewal fee thereafter is $22.50.)

3.2.3 File a bond in the penal sum of $5000 with the state engineer, conditioned upon compliance with the law and these rules, and effective for the calendar year in which the license is to be issued.

3.2.4 Obtain a score of at least 70% on the written or oral examination administered by the state engineer to test the applicant's knowledge of:

a) Utah Water Law as it pertains to underground water;
b) Land description by section, township, and range;
c) Geologic formations and proper names used in describing underground material types;
d) Groundwater geology and the occurrence and movement of groundwater;
e) The rules for water well drillers;
f) The minimum standards for well construction;
g) The proper construction methods and techniques for the various types of well drilling rigs, and equipment the applicant proposes to use to construct wells in the state.

3.2.5 If the applicant fails to obtain the minimum passing score on the written/oral examination, he may make re-application to the state engineer for a license and re-examination 90 days from the date of the previous application.

3.2.6 Have reached the age of majority.

3.2.7 The state engineer may issue a restricted or conditional license to an applicant based on his drilling performance and compliance with established rules and construction standards for a time period prescribed by the state engineer.

3.3 OPERATOR REGISTRATION.

3.3.1 An operator may become registered with the State Engineer's Office in order to substantiate claims of experience when applying for his own well driller's license at some future date.

3.3.2 An operator may become registered with the State Engineer's Office by doing all of the following:

3.3.2.1 Filing an application with the state engineer on forms provided for that purpose.

3.3.2.2 Obtaining a score of at least 70% on a written and/or oral examination to test the applicant's knowledge of:

a) Land description by section, township, and range;
b) Geologic material and proper names used in describing underground material types;
c) The rules for water well driller's; and
d) The minimum standards for well construction.

3.3.2.3 An operator must be under the supervision of a well driller holding a current Utah Well Driller's license. Such supervisor need not be continually present at the drilling site but must be available to provide supervision as the work progresses.

3.4 DRILLING WITHOUT A LICENSE. Any person found to be drilling a well without a valid well driller's license will be ordered to cease and desist by the state engineer. Such order may be made verbally but must be followed by a written order. The order may be posted at an unattended well site. A person found drilling without a license will be prosecuted under Title 73-3-26, Utah Code Annotated 1953. (See Section 5.8)

4 GENERAL REQUIREMENTS

4.1 All drillers, as a condition of the continuation of their license to drill wells in Utah shall do all of the following:

4.1.1 Prior to commencing any work on a well, file written notice of that intention on a card furnished by the state engineer. The notice shall include the following:

a) The date on which it is proposed to commence work;
b) The nature of the work to be performed;
c) The owner's name for whom the well is to be drilled, or renovated.
d) The area code number, application number, change application number, exchange number, or underground water claim number on file in the State Engineer's Office shall be indicated. If the well is to be drilled under an approved test well or monitor well letter, the approval date and approval number.
e) The diameter of casing to be used;

f) The location of the well by section, township and range;
g) The card shall be signed by the licensed well driller.

When authorization is given to drill wells at more than one point of diversion, notice shall be given for each location to be drilled.

4.1.2 Comply with the minimum well construction standards as adopted by the state engineer and hereinafter included.

4.1.3 Have a qualified operator at the well site at all times during the actual work of construction, development or abandonment of the well. All persons operating under a well driller's license shall be employees of the well driller and use the licensed well driller's equipment. All wells, when unattended during construction or renovation, shall be securely covered.

4.1.4 Not allow any person to engage in the well drilling business under the authorization of their license without prior review and written consent of the state engineer.

4.2 The well driller's license number must be prominently displayed on every well drilling rig they operate in the state.

4.3 Within thirty (30) days of the completion or abandonment of any well, the driller shall file a report with the state engineer giving the data relating to that well. The report shall be made on forms furnished by the state engineer and shall contain such information as he may require, including but not limited to the following:

a) The name and post-office address of the driller;
b) The name and post-office address of the well owner;
c) The area code number of the valid authorization to drill or in the case of a well drilled under a test well or monitor well letter, the date of the letter and designated approval number;
d) The location of the well;
e) The size and type of casing, perforations, packers, seals, etc.;
f) The depth of the well;
g) The log of the well;
h) The beginning and completion dates for construction, renovation or abandonment of the well;
i) The temperature and quantity of water issuing, drawn, or pumped therefrom;
j) The location of all water-bearing strata.
k) The static water level in the well at the time of completion.
For the purposes of these rules, a well will be considered completed or abandoned when the well driller removes his drilling rig from the well site, unless the well driller provides written notice to the state engineer that he plans to continue work at some later date.

4.4 The well driller shall have the required penal bond continually in effect during the term of the well driller's license.

4.5 The well driller shall make certain that a valid authorization or approval exists to drill before beginning drilling. The authorizations to drill listed in Section 2.23, allow the applicant to contract with a well driller to drill, or renovate exactly one well at each location listed on the approved form. When the work is completed or abandoned, the permission to drill is terminated. An approved test well or monitor well letter is a special case permitting exploratory drilling but allowing only enough water to be diverted to determine the characteristics of the ground water source.

5 PENALTIES

5.1 The state engineer, upon investigation and after a hearing, on at least ten days' notice given to the licensee by registered mail, may revoke or suspend any well driller's license either permanently or for a fixed period determined by the state engineer, if he finds that the well driller has done any of the following:

a) Intentionally made a material misstatement of facts in his application for a license;
b) Intentionally made a material misstatement of fact in a well driller's report;
c) Been found to be incompetent as a well driller;
d) Willfully violated any of the prescribed rules;
e) Failed to submit notice of intention to drill in accordance with these rules;
f) Failed to submit a report of well driller, completed in accordance with these rules.
g) Allowed any person to operate under their license without prior written approval by the state engineer.

5.2 If the state engineer determines, following an investigation and a hearing upon at least ten days notice to the licensee, by registered mail, that the licensee has failed to comply with the rules, the state engineer may exact the bond and deposit the money as a non-lapsing dedicated credit.

5.3 The state engineer may expend the funds to investigate or correct any deficiencies which could adversely affect the public interest resulting from non-compliance with the rules by any well driller.

5.4 After the period set by the state engineer under a revocation or suspension has expired, a well driller may make application for a new license.

5.5 A well driller who has had his license revoked or suspended will be prohibited from operating well drilling equipment during the revocation or suspension period set by the state engineer.

5.6 The state engineer may, upon investigation and after a hearing, refuse to issue a license to an applicant if it appears:

a) That he has not had sufficient training or experience to qualify him as a competent well driller or;
b) That he has intentionally violated the Utah Statutes governing well drillers or these rules relating to well drilling or;
c) That he has intentionally made a material misstatement of fact in an

application for a license, in a well driller's report, or in any other document filed in the State Engineer's Office.

5.7 Lack of knowledge of the law or the rules relating to well drilling shall not constitute an excuse for violation thereof.

5.8 *Title 73 Chapter 3 Section 26 of the Utah Code Annotated 1953 provides that:*
(1) Any person that does any of the following is guilty of a Class B misdemeanor:
(a) Constructs a well without first obtaining a license as required by this chapter;
(b) Advertises to be a well driller without first obtaining a license as required by this chapter;
(c) Constructs a well after suspension revocation or expiration of his license;
(d) Constructs a well in violation of the rules promulgated under Subsection 73-3-25 (1).
(2) Each day of failure to comply with the provisions of this section constitutes a separate offense.

6 RENEWAL OF WELL DRILLER'S LICENSE AND QUALIFICATION OF OPERATORS

6.1 ACTIVE LICENSES.

6.1.1 All well driller's licenses expire on December 31 of the year in which they are issued. Renewal of license will be made upon payment of a $22.50 fee, written application to the state engineer, submission of proof of $5000 penal bond for the next year, and proper submission of all start cards and well logs for the current year. Renewal of an operator's registration will be made upon written application to the state engineer.

6.1.2 Having met all requirements as set forth in 6.1.1 on or before December 31, the licensee shall be authorized to operate as a well driller until his new license is issued.

6.1.3 License renewal applications not meeting the requirements of section 6.1.1 and/or received after their December 31 expiration date will be assessed an additional $22.50 administrative late fee before the state engineer will consider license renewal.

6.2 RENEWAL OF INACTIVE LICENSES.

6.2.1 Drillers who have held an active license within the previous 24 months shall make application under provisions of Section 6.1.

6.2.2 Drillers who have not held an active license within the previous 24 months shall make application under the provisions of Section 3.2.

Part II

MINIMUM CONSTRUCTION STANDARDS

7 GENERAL

7.1 GENERAL. The failure of a water well driller to abide by these minimum standards can result in any of the following:
(1) the revocation or suspension of his well driller's license.
(2) a finding that he is guilty of a misdemeanor.
(3) the exacting of his bond by the state engineer. In some locations, the compliance with the following minimum standards will not result in a well being free from pollution or from being a source of subsurface leakage, waste, or contamination of the groundwater supply. Since it is impractical to attempt to prepare standards for every conceivable situation, the well driller shall use his judgement to construct wells under more stringent standards when such precautions are to protect the groundwater supply and those using the well in question.

7.2 *WELL CASING. It shall be the sole responsibility of the well driller to* determine the suitability of any type of well casing for the particular well he is constructing, in accordance with these minimum requirements. The well casing shall extend a minimum of 18 inches above ground level and the natural ground surface should slope away from the casing.

7.2.1 Steel Casing. All steel casing intalled in Utah shall be in new or like-new condition, being free from pits or breaks, and shall meet the minimum specifications listed in Table 1.

TABLE -1-

MINIMUM WALL THICKNESSES FOR STEEL WELL CASING

Nominal Casing Diameter (In)	DEPTH 0 to 200 (Ft)	200 to 300 (Ft)	300 to 400 (Ft)	400 to 600 (Ft)	600 to 800 (Ft)	800 to 1000 (Ft)	1000 to 1500 (Ft)	1500 to 2000 (Ft)
2	.154	.154	.154	.154	.154	.154	....	....
3	.216	.216	.216	.216	.216	.216	....	....
4	.237	.237	.237	.237	.237	.237	.237	.237
5	.250	.250	.250	.250	.250	.250	.250	.250
6	.250	.250	.250	.250	.250	.250	.250	.250
8	.250	.250	.250	.250	.250	.250	.250	.250
10	.250	.250	.250	.250	.250	.250	.313	.313
12	.250	.250	.250	.250	.250	.250	.313	.313
14	.250	.250	.250	.250	.313	.313	.313	.313
16	.250	.250	.313	.313	.313	.313	.375	.375
18	.250	.313	.313	.313	.375	.375	.375	.438
20	.250	.313	.313	.313	.375	.375	.375	.438
22	.313	.313	.313	.375	.375	.375	.375	.438
24	.313	.313	.375	.375	.375	.438	....	....
30	.313	.375	.375	.438	.438	.500	....	....

7.2.2 Plastic Casing. PVC, SR, ABS, etc. casing may be installed in Utah upon obtaining permission of the well owner. Plastic well casing shall be manufactured and installed to conform with ANSI/ASTM F 480-81, SDR 21 or the most recent revision thereof. The casing is normally marked "WELL CASING" and with the ANSI/ASTM designation "F 480-81, SDR-21". All plastic casing for use in potable water supplies shall be manufactured to be acceptable to the National Sanitation Foundation Testing Laboratory, Inc. Other types of plastic casings may be installed upon manufacturers certification that such casing meets or exceeds the above described ASTM/SDR specification. Minimum specifications are given in Table 2.

TABLE -2-

WALL THICKNESS FOR THERMOPLASTIC WATER WELL CASING PIPE

Nominal Casing Diameter (In.)	Minimum Thickness (In.)	SDR
2	0.133	21
2.5	0.137	21
3	0.167	21
3.5	0.190	21
4	0.214	21
5	0.265	21
6	0.316	21
8	0.410	21
10	0.511	21
12	0.606	21
14	0.667	21
16	0.762	21

ASTM Specification, F480-81

7.3 CASING JOINTS. All well casing joints shall be made water tight. In instances in which a reduction in casing diameter is made, there shall be enough overlap of the casings to prevent misalignment and to insure the making of an adequate seal in the annular space between casings to prevent the movement of unstable sediment into the well, in addition to preventing the degradation of the water supply by the migration of inferior quality water through the annular space between the two casings.

7.3.1 Steel Casing. All steel casing shall be screw-coupled or welded. If the joints are welded, the weld shall be at least as thick as the wall thickness of the casing and shall consist of at least two beads for the full circumference of the joint.

7.3.2 Plastic Casing. All plastic well casing shall be either screw coupled or chemically welded as per ANSI/ASTM F480-81 standards. Metal screws driven into casing joints shall not be long enough to penetrate the inside surface of the casing. Metal screws should be used only when cold (below 50 deg. F) temperatures retard the normal setting of the cement.

7.4 MINERALIZED OR POLLUTED WATER. Whenever a water bearing stratum that contains nonpotable mineralized or polluted water is encountered, the stratum shall be adequately sealed off so that contamination of the overlying or underlying groundwater zones will not occur.

7.5 EXPLOSIVES. Explosives used in well construction shall not be detonated within the section of casing designed or expected to serve as the surface seal of the completed well, whether or not the surface seal has been placed.

7.6 CHLORINATION OF WATER. No contaminated water shall be placed in a well during construction. Water should be obtained from a chlorinated municipal system. Where this is not possible, the water must be treated to give 100 ppm free chlorine residual. Table 3 gives the amount of bleach or dry powder required per 100 gallons of water to mix a 100 ppm solution.

TABLE -3-

AMOUNT OF HYPERCHLORITE FOR EACH 100 FEET OF WATER STANDING IN WELL (100 ppm soluton)

Well Diameter (inches)	5.25% Solution (cups)*	25% Powder (ounces)	70% Powder (ounces)**
2	0.50	1.00	0.50
4	2.25	3.50	1.50
6	5.00	8.00	3.00
8	8.50	14.50	5.50
10	13.00	22.50	8.50
12	19.00	32.50	12.00
14	26.00	44.50	16.50
16	34.00	58.00	26.00
20	53.00	90.50	33.00
100 gal	3.50	5.50	2.00

* Common Laundry Bleach

** HTH - High Test hypochlorite

7.7 ACCESS PORT. Every well shall be equipped with a usable access port so that the position of the water level, or pressure head, in the well can be measured at all times.

7.8 PROTECTION OF AQUIFER. The well driller shall take due care to protect the producing aquifer from clogging or contamination. He shall make every effort to remove all substances and materials introduced into the aquifer or aquifers during well construction. "Substances and materials" shall mean all drilling fluids, filter cake, lost circulation materials, and any other organic or inorganic substances added to the drilling fluid that may seal or clog the aquifer or provide a medium for the growth of organisms. This is especially important in the construction of wells designed to be used as a public drinking water supply.

7.9 COMPLETION OR ABANDONMENT. A licensed driller shall not remove his drill rig from a well site unless the well is completed or abandoned. Completion of a well shall include all surface seals, gravel packs or curbs required. Abandonment of a well shall be in compliance with Section 12.

8 DRILLED WELLS

Drilled wells shall be drilled in compliance with the following standards. Bored, jetted, or driven wells shall be considered to be drilled wells for purposes of these rules.

8.1 WELL CASING. All well casing installed shall meet the minimum standards given in Sections 7.2.1 and 7.2.2. Plastic casing is not recommended for use in wells drilled by the Cable Tool method.

8.2 SEALING OF CASING. All drilled wells shall have a surface seal installed in accordance with the provisions of Table 4. Neat cement grout, sand cement grout, bentonite or expansive clays may be used in the surface seal. All grout placed deeper than 30 feet or under water shall be placed by tremie line, pumping, or pressure. Portland Cement grouts must be allowed to cure a minimum of 72 hours for Type I cement or 36 hours for Type III cement before construction or pump testing may be resumed.

TABLE -4-

CASING GROUTING TABLE

Overburden	Minimum Grouting Depth	Minimum Non-Perforated Casing Depth
Unconsolidated, Permeable Formations	18 Feet to Surface	Below Lowest Pumping Level
Clay or Stratified Deposits of Sand, Gravel, and Clay	18 Feet to Surface and Driven 5 Feet Into an Impervious Clay Layer	Top of the Uppermost Producing Zone
Consolidated Rock	18 Feet to Surface and Grouted 5 Feet Into a Rock Formation	18 Feet or 5 Feet Into the Rock Formation

8.2.1 Casing. Non-perforated casing shall be installed to the minimum depths given in Table 4. A perforated liner, well screen, or smaller casing may be installed below the well casing, if necessary, to complete the well. The annular space between the two casings shall be sealed water-tight with grout, expansive clay, or a mechanical packer. Figures 1, 2, 3, and 4 illustrate typical well completions in the various formations listed in Table 4.

8.3 GRAVEL PACKED WELLS.

8.3.1 Oversize Hole. The diameter of the borehole shall be at least four inches larger than the diameter of the casing to be installed to allow for proper placement of the gravel/filter pack and adequate clearance for treamie pipe for grout/surface seal installations (Figure 4).

8.3.2 Filter Material. The filter material shall consist of clean, well rounded grains that are smooth and uniform. The filter material should not contain more than 2% by weight of thin, flat, or elongated pieces and should not contain organic impurities or contaminants of any kind. In order to assure that no contamination is introduced into the well, the gravel pack should be washed with a 100 ppm solution of chlorinated water (Table 3) or dry chlorine should be mixed with the gravel pack at the surface before it is introduced into the well.

8.3.3 Placement of Filter Material. All filter material shall be placed using a method that through common usage has been shown to minimize 1) bridging of the material between the borehole and the casing, and 2) excessive segregation of the material after it has been introduced into the annulus and before it settles into place.

8.3.4 No Surface Casing Used. If no permanent surface casing is installed, a cement grout or puddling clay seal shall be installed to at least 5 feet into a clay layer or other tight formation overlying the producing zone. The well seal shall extend down at least 18 feet from the land surface.

8.3.5 Surface Casing Used. If permanent surface casing is installed, it shall be unperforated and installed in accordance with Table 4. After the gravel pack has been installed, the inner casing may be sealed by either welding a water-tight steel cap between the two casings at land surface or filling the annular space between the two casings with cement grout, bentonite, or puddling clay from 18 feet to the surface.

8.4 SPECIAL ADDITIONAL STANDARDS FOR ARTESIAN WELLS.

8.4.1 Sealing of Casing. Unperforated well casing shall extend into the confining stratum overlying the artesian zone, and shall be adequately sealed into the confining stratum so as to prevent both surface and subsurface leakage from the artesian zone.

8.4.2 Elimination of Leakage. If leaks occur around the well casing or adjacent to the well, the well shall be completed with the seals, packers, or casing necessary to eliminate the leakage.

8.4.3 Control Valves. If a well flows, it shall be equipped with a suitable control valve. The control valve, must be available for inspection at all times.

9 DUG WELLS

9.1 SURFACE CURBING.

9.1.1 All dug wells greater than 12 feet in depth shall be constructed with a water-tight surface curbing extending to a depth of 18 feet, or to within 3 feet of the bottom of the well in the case of wells ranging from 12 to 21 feet in depth. The surface curbing shall be of concrete, concrete tile, or steel. If concrete is used, the wall thickness shall not be less than 6 inches. In the case of the buried slab type of well, well casing meeting the minimum specifications given in Sections 7.2.1 and 7.2.2 must be installed (Figure 5).

9.1.2 If precast concrete tile or steel is used for the surface curbing, the well diameter to the bottom of the surface curbing shall be 8 inches greater than the outside diameter of the tile or steel and the annular space shall be filled with concrete.

9.1.3 Well Seal. In a buried-slab type of well, the slab shall be at least 18 feet below land surface. The slab shall be sealed with cement grout and the well bore backfilled with puddled clay (Figure 5).

10 DEEPENING OR RENOVATION OF WELLS

10.1 SEALING OF CASING. If in the repair of a drilled well, the old casing is withdrawn, the well shall be recased in accordance with the rules set forth in Section 8.

10.2 INNER CASING. If an inner casing is installed to prevent leakage of undesirable water into a well, the space between the two well casings shall be completely sealed using packers, casing swedging, pressure grouting, etc., so as to prevent the movement of water between the casings.

10.3 OUTER CASING. If the "over-drive" method is used to eliminate leakage from the existing well, the casing driven over the well shall meet the minimum specifications listed in Section 7.2.1.

10.4 ARTESIAN WELL. If upon deepening an existing well, an artesian zone is encountered, the well shall be cased and completed as set forth in Section 8.

10.5 DRILLING IN A DUG WELL. A drilled well may be constructed through an existing dug well provided that:

10.5.1 An unperforated section of well casing extends from a depth of at least 10 feet below the bottom of the dug well and at least 20 feet below land surface to above the maximum water surface in the dug well, and

10.5.2 A 2 foot thick seal of concrete or puddled clay is placed in the bottom of the dug well so as to prevent the direct movement of water from the dug well into the drilled well, and

10.5.3 The drilled well shall be pumped or bailed to determine whether the seal described above is adequate to prevent movement of water from the dug well into the drilled well. If the seal leaks, additional sealing and testing shall be performed until a water tight seal is obtained.

11 SPECIAL STANDARDS FOR PARTICULAR WELLS

11.1 UNUSUAL CONDITIONS. If unusual conditions occur at a well site and compliance with these rules and standards will not result in a satisfactory well or protection to the water supply, a licensed water well driller may request that special standards be prescribed for a particular well. The request for special standards shall be in writing and shall set forth the location of the well, the name of the owner, the unusual conditions existing at the well site, the reasons that compliance to the rules and minimum standards will not result in a satisfactory well, and the proposed standards that the licensed water well driller believes will be more adequate for this particular well. If the state engineer finds that the proposed changes are in the best interest of the public, he will approve the proposed changes by assigning special standards for the particular well under consideration.

11.2 SPECIAL STANDARDS. If in the course of investigating the groundwater resources of Utah, the state engineer finds that special standards are required for the development of groundwater from any particular groundwater reservoir or area, special standards for the construction and maintenance of wells may be prescribed.

11.2.1 Special Water Well Casing Standards for the 71, 73, 75, and 77 Drainage Areas.

11.2.1.1 During the course of his investigations of groundwater in the previously mentioned drainages, the state engineer has found that a variance in water well casing wall thicknesses is warranted. This special standard shall apply only in those specific areas hereinafter defined. The casing specifications adopted in Section 7.2.1 and 7.2.2 of these rules shall govern in all other parts of the affected drainage areas.

11.2.1.2 It shall be the sole responsibility of the water well driller to install casing suitable to the conditions encountered at the well site, in accordance with these minimum specifications.

11.2.1.3 Steel Casing. All steel casing installed under this section shall be new or in like-new condition free from pits or breaks and shall meet the minimum specifications listed in Table 5.

TABLE -5-

WALL THICKNESS FOR STEEL WATER WELL PIPE

Nominal Casing Diameter (Inches)	Minimum Wall Thickness (Inches)
4	0.188
6	0.188
8	0.188
10	0.250
12	0.250
14	0.250
16	0.250
18	0.250
20	0.250

11.2.1.4 Casing Joints. All casing joints shall be made in conformance to Sections 7.3, 7.3.1, and 7.3.2.

11.2.1.5 Applicable Areas. This special standard shall apply only in the specific areas listed below.

71 Area. Those parts of the 71 drainage area in Washington, Iron, and Beaver Counties below an elevation of 6,000 ft. MSL. Those parts of the 71 drainage area in Millard County below an elevation of 5,200 ft. MSL.

73 Area, 75 Area. Those parts of the 73 and 75 drainage areas in Iron County below an elevation of 6,000 ft. MSL.

77 Area. Those parts of the 77 drainage area in Beaver County below an elevation of 6,000 ft. MSL.

12 ABANDONMENT OF WELLS

12.1 TEMPORARY ABANDONMENT. When any well is temporarily removed from service, the top of the well shall be sealed with a water-tight cap or seal. If the well is temporarily abandoned during construction, it shall be assumed that the well is permanently abandoned after 90 days, and a well driller's report will be submitted in compliance with Section 4.3 of these rules.

12.2 PERMANENT ABANDONMENT. Any well that is to be permanently abandoned shall be completely filled in such a manner as to prevent vertical movement of water within the borehole as well as preventing the annular space surrounding the well casing from becoming a conduit for possible contamination of the groundwater supply.

12.3 LICENSE REQUIRED. Well abandonment shall be accomplished under the direct supervision of a currently licensed water well driller who shall be responsible for verification of the procedures and materials used.

12.4 MATERIALS USED. The following materials may be used in the permanent abandonment of wells:

1) Neat Cement conforming to ASTM standard C150 of sufficient weight (not less than 15 lbs/gallon) to prevent the flow of any water into the hole from any aquifer penetrated.
2) Cement grout consisting of equal parts of cement conforming to ASTM standard C150 and sand/aggregate with no more than 6 gallons of water per sack of cement.
3) Bentonite-based products specifically designed for permanent well abandonment, which are mixed and placed according to manufacturer's recommended procedures (i.e. Plug-Gel, Shur-Gel, etc.).
4) The liquid phase of the abandonment fluid shall be non-saline water containing no chemicals or toxic materials or other substances which may decompose or possibly contaminate the groundwater supply.

12.5 PLACEMENT OF MATERIALS.

1) Neat cement and cement grout shall be introduced at the bottom of the well or required sealing interval and placed progressively upward to the top of the well. Said sealing material shall be placed by the use of a grout pipe, treamie line or dump bailer in order to avoid segregation or dilution of the materials.
2) Bentonite-based products shall be mixed and placed according to manufacturer's recommended procedures.

12.6 TERMINATION OF CASING. The casings of wells to be abandoned shall be severed a minimum of 2 feet below either the natural ground surface adjacent to the well or at the collar of the hole, whichever is the lower elevation. A minimum of 2 feet of compacted native material shall be placed above the abandoned well upon completion.

12.7 REPORT OF ABANDONMENT. Within 30 days of the completion of well abandonment procedures, a report must be submitted to the state engineer by the responsible licensed driller giving data relating to the abandonment of the well. The report shall be made on forms furnished by the state engineer and shall contain such information as he may require, including but not limited to the following:

1) Name of licensed driller or other person(s) performing abandonment procedures.
2) Name of well owner at time of abandonment.
3) Address or location of well by section, township and range.
4) Abandonment materials, equipment and procedures used.
5) Water right or file number covering the well.
6) Final disposition of the well.
7) Date of completion.

12.8 ABANDONMENT OF ARTESIAN WELLS. A cement grout or concrete plug shall be placed in the confining stratum overlying the artesian zone so as to prevent subsurface leakage from the artesian zone. The remainder of the well shall be filled with cement grout, concrete, bentonite products, or puddled clay.

12.9 ABANDONMENT OF DRILLED AND JETTED WELLS. A cement grout or concrete plug shall be placed opposite all perforations or openings in the well casing. The remainder of the well shall be filled with cement grout, concrete, bentonite products, or puddled clay.

12.10 ABANDONMENT OF GRAVEL PACKED WELLS. All gravel packed wells shall be pressure grouted throughout the perforated section of the well casing. The remainder of the well shall be filled with cement grout, concrete, bentonite products, or puddled clay.

12.11 PLUGGED WELLS. If it is desired to remove the well casing during abandonment, the well shall be plugged as the casing is removed. The well shall be plugged with cement grout, concrete, bentonite products, or puddled clay. In the case of gravel packed wells, the entire gravel section shall be pressure grouted.

12.12 REPLACEMENT WELLS. Wells which are to be removed from operation and replaced by the drilling of a new well, under an approved replacement application, shall be abandoned in a manner consistent with the provisions of this section before the rig is removed from the site.

13 WELLS INTENDED FOR PUBLIC DRINKING WATER SUPPLIES

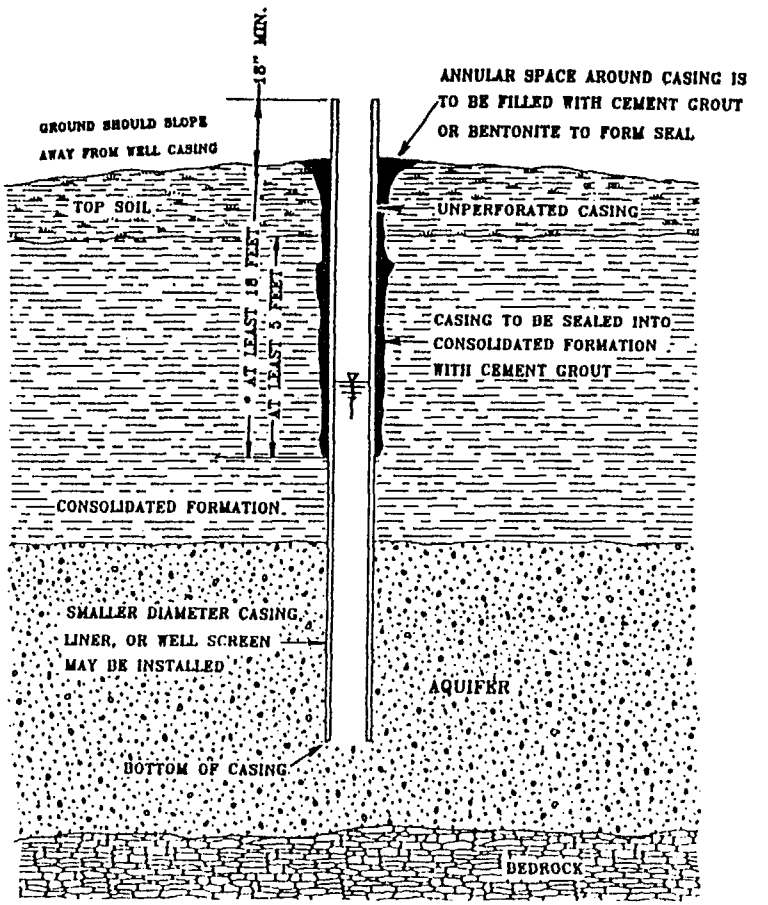
13.1 Each driller shall be familiar with the requirements of the Utah State Department of Health, Bureau of Drinking Water/Sanitation and with respect to public supply wells. Rules governing public drinking water supplies are given in the "State of Utah Public Drinking Water Regulations" available from the Utah State Bureau of Drinking Water/Sanitation and (State Department of Health).

When drilling wells intended for public drinking water use, the driller should be familiar with and acquaint his client with local or state health department rules which require, among other things:

a) Plans and specifications for the well to be reviewed and approved by the Bureau of Drinking Water/Sanitation before construction begins.
b) Minimum grouting distances below the surface.
c) Minimum distances between the well and any concentrated sources of pollution (e.g. septic tanks, septic tank drainfields, garbage dumps, pit privies, drain lines, sewer lines, corrals, feedlots, etc.).

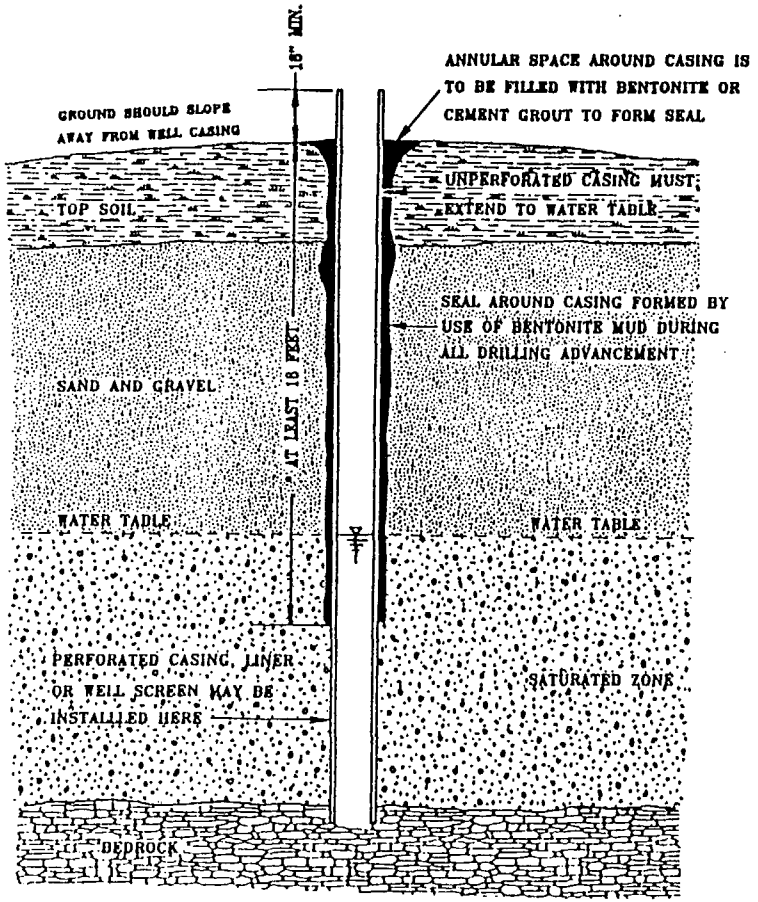
13.2 A representative of the State Engineer's Office or the Bureau of Drinking Water/Sanitation and must be present at the time the surface seal is placed in all public supply wells so that the placement of the seal can be certified. In order to assure that a representative will be available, and to avoid down-time waiting for a representative, notice should be given several days in advance of the projected seal placement. When the time and date are finally set, a definite appointment should be made with the representative.

FIGURE 1: CONSTRUCTION OF A DRILLED WELL
THE AQUIFER IS OVERLAIN BY A
CONSOLIDATED FORMATION



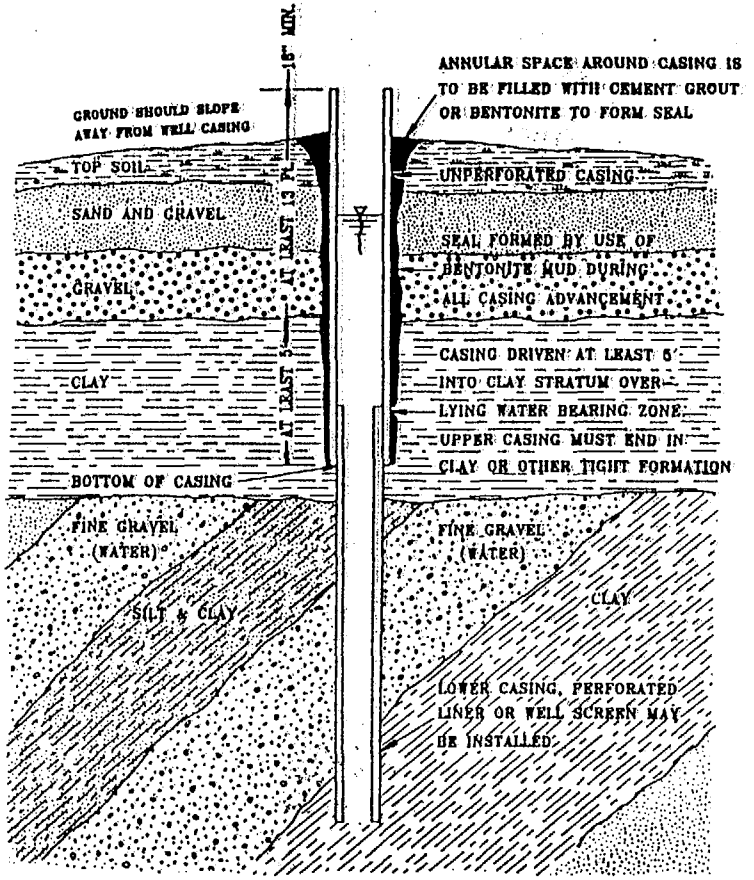
* IF THE WELL IS TO BE USED AS A PUBLIC SUPPLY WELL THE GROUT MUST EXTEND A MINIMUM OF 2" AROUND THE CASING & TO A MINIMUM OF 100' BELOW THE SURFACE

FIGURE 2: CONSTRUCTION OF A DRILLED WELL
THE AQUIFER IS OVERLAIN BY A
PERMEABLE SAND OR GRAVEL



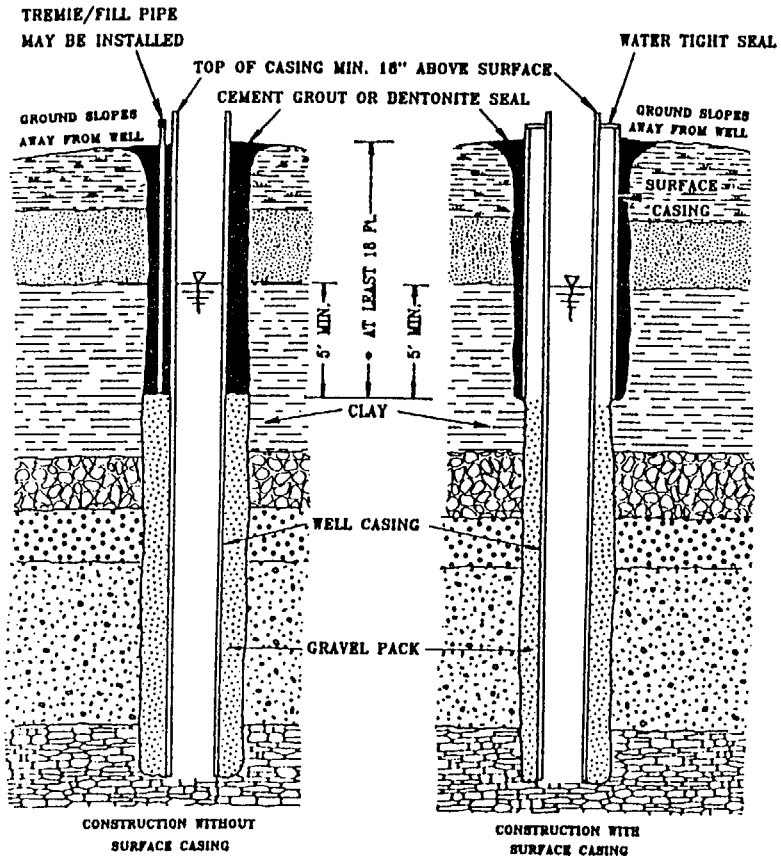
* IF THE WELL IS TO BE USED AS A PUBLIC SUPPLY WELL THE GROUT MUST EXTEND TO A MINIMUM OF 2" AROUND THE CASING & TO A MINIMUM OF 100 FT. BELOW THE SURFACE

FIGURE 3: CONSTRUCTION OF A DRILLED WELL
THE AQUIFER IS OVERLAIN BY
STRATIFIED FORMATIONS



* IF THE WELL IS TO BE USED FOR PUBLIC SUPPLY AND CLAY LAYER ABOVE PRODUCING ZONE IS AT LEAST 30 Ft. THICK, THE GROUT MUST EXTEND FROM THE SURFACE TO A POINT 5 FEET INTO THE CONFINING CLAY LAYER.

FIGURE 4: CONSTRUCTION OF GRAVEL PACKED WELLS INSTALLED WITH AND WITHOUT SURFACE CASINGS



* ALL GROUT PLACED DEEPER THAN 30' OR UNDER WATER SHALL BE PLACED BY TREMIE, PUMPING OR PRESSURE PUBLIC SUPPLY WELLS MUST BE GROUTED TO 100'.

FIGURE 5: CONSTRUCTION OF DUG WELLS

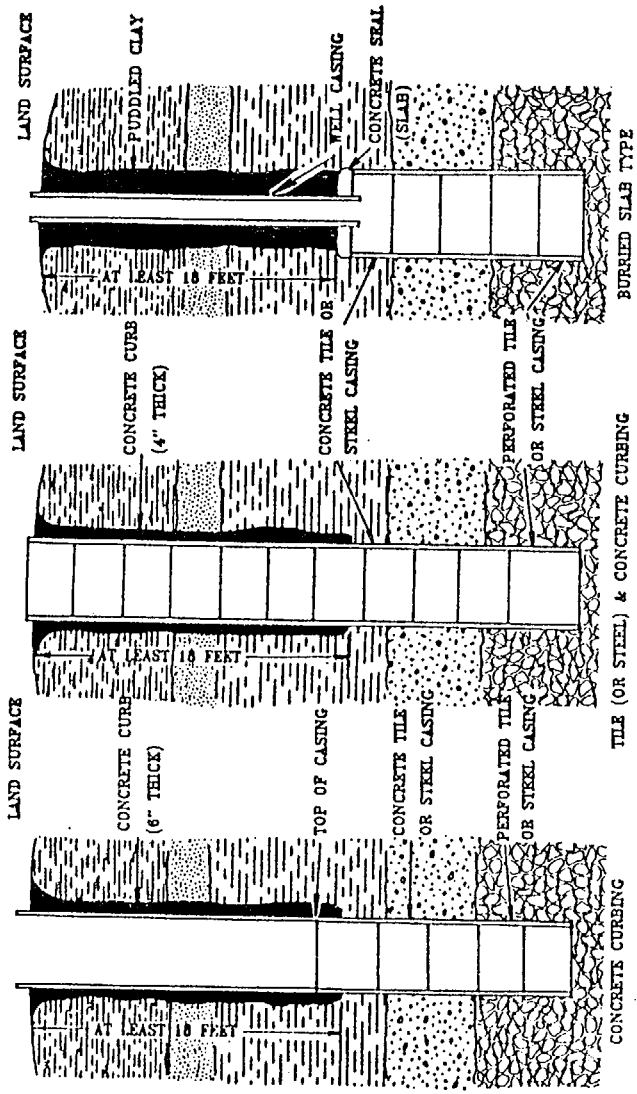
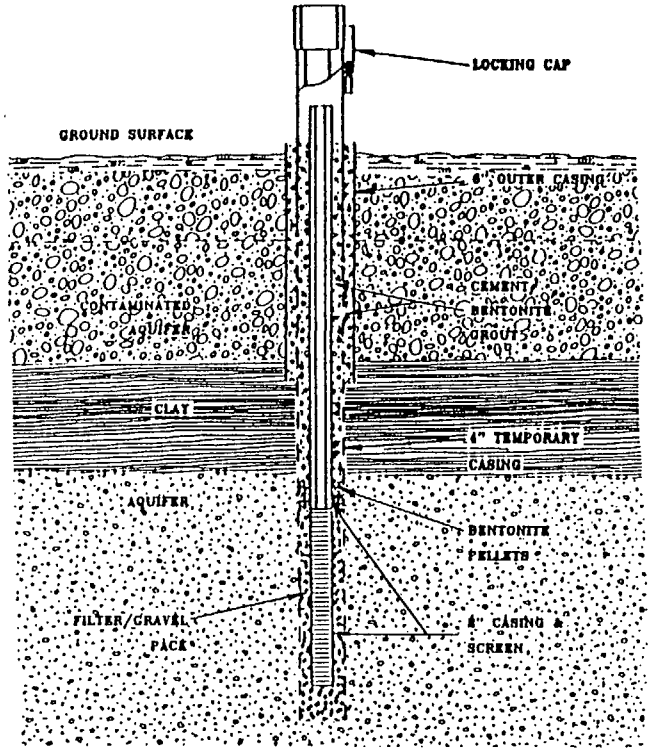


FIGURE 6: CONSTRUCTION OF MONITOR WELL (TYPICAL)



*POTENTIAL CROSS-CONTAMINATION OF AQUIFERS CAN BE ELIMINATED WITH PROPER MONITOR WELL CONSTRUCTION

APPENDIX I

MONITOR WELL INSTALLATION GUIDELINES AND RELATED INFORMATION

GENERAL

Most, if not all, monitor well projects are the result of compliance with EPA, Federal Regulations such as the Resource Conservation & Recovery Act (RCRA) or specific State Solid and Hazardous Waste requirements. The contracts governing their installation are tightly written containing specific requirements as to site location, materials used, sampling procedures and overall objectives. The following monitor well guidelines address only the procedures required to obtain actual approval to drill and the commonly acceptable construction and installation practices for monitor wells.

All monitor wells constructed in the state will be installed by a currently licensed Utah Water Well Driller.

APPROVAL

Approval for monitor well projects are issued by the state engineer following review of written requests from the owner/applicant, federal or state agency or engineering representative. The requests for approval should include the following information:

1) General location or common description of the monitoring project.
2) Specific course and distance locations of all requested locations (or location by 1/4, 1/4 section)
3) Total anticipated number of wells to be installed.
4) Diameters, approximate depths, materials used, in the wells.
5) Projected start and completion dates.
6) Name and license number of driller contracted to install the wells.

Upon written approval by the state engineer, the project will be assigned an approved authorization number which will be referenced by the licensed driller on all start cards and well drillers reports as required by Sections 4.1.1 and 4.3 of these Rules.

INSTALLATION

All material used in the installation of monitor wells should be sterile and contaminant free when placed in the ground. During construction contaminated water should not be allowed to enter contaminant-free geologic formations or water bearing zones. Some minor cross-contamination may occur during drilling, but the integrity of the borehole and individual formations must then be safeguarded. The well casing should be perforated or screened and filter packed with sand or gravel where necessary to provide adequate sample collection at depths where appropriate aquifer flow zones exist. The annular space between the borehole and casing should be adequately sealed using bentonite-slurry, pellets or cement grout. The gravel or filter pack should generally extend 2 ft. to 10 ft. above the screened or perforated area to prevent the migration of the sealing material from entering the zones being sampled. Drill cutting should not be placed into the open borehole annulus.

DRILLING METHODS

Monitor wells may be installed using a variety of commonly recognized drilling methods. The method used should minimize the disturbance of subsurface materials and consequently reduce possible cross-contamination of groundwater zones. The drilling method is a function of the site specific geologic conditions which may make one method more suitable than another. Regardless of the method used, the well rig and support equipment should be steam cleaned and decontaminated before use and between borehole locations to prevent cross-contamination of wells.

All methods employed in monitor well construction have inherent advantages and disadvantages which can be compared in Table 6.

TABLE 6

DRILLING METHODS FOR MONITOR WELLS

Type	Advantages	Disadvantages
Mud Rotary	*Readily available *Capable of drilling hard or soft formations. *Core sampling available *No depth restrictions *Small rigs for accessibility *Logging fairly reliable *Relatively inexpensive	*Drilling fluid invades formation; hard to remove *Bentontic fluids absorb metals *Organic fluids interfere with bacterial/organic analysis *Limited information on water zones *Drilling fluids circulate contaminants
Air Rotary	*No drilling fluid-reduced contamination *Used in consolidated & unconsolidated formations *No depth restrictions *Excellent sampling in hard, dry formations *Easy collection & field analysis of blown water *Fast & readily available.	*Casing required in soft, caving formations *Multiple water zones-difficult to properly case and grout off different zones *Relatively expensive
Air Rotary with Casing Hammer	*Caving formations can be drilled *Multiple levels can be penetrated & sampled	*Limited availability *Higher operating costs *Casing pull-back is difficult

Cable Tool	*Small amounts of water required-no fluid additives *Used in consolidated & unconsolidated formations *No depth restrictions *Good formation samples *Observed water level changes *Good seal between casing & formation *inexpensive operation	*4-inch minimum casing size *Limited geophysical logs *Relatively slow
Reverse Circulation (Dual Wall Pipe)	*Formation water not contaminated by drilling water *Excellent formation samples *With air - immediate information on water bearing zones *Reduced caving of hole	*Rare - expensive to operate *Difficult grout placement outside casing - above screen
Hollow-Stem (Continuous Flight Auger)	*Mobile, fast, inexpensive to operate in unconsolidated formations *No drilling fluid-reduced contamination *Reduced caving problems-casing & screen placement inside of augers *Gamma Ray logging inside hollow stem-nature & thickness of formations *Continuous placement of grout seal as augers are removed.	*Limited depth - usually 100 - 150 ft. *Not used in consolidated, rock formations *Limited accuracy of samples *Depth to water table difficult to determine in deep borings
Solid Stem Auger	*Mobile, fast, inexpensive to operate in unconsolidated formations *No drilling fluid-reduced contamination	*Not used in rock formations *Limited depth, 100-150 ft. *Difficult to maintain open hole, especially below water table *Limited accuracy of samples

MATERIALS USED

Casing & Screens

There are several materials currently approved for the use in the installation of monitor wells. Most of the monitor project contracts will specify which materials are to be used based on the anticipated pollutants being monitored. The cost of the materials varies greatly, and it may be realistic to balance sample accuracy with overall cost, especially in regard to casing and intake portions of well construction. There are some exotic materials being developed for monitor well use; however, the more common casing and screen materials now being used and their advantages and disadvantages can be compared in Table 7.

TABLE 7

MONITOR WELL CASING & SCREEN MATERIALS

Type	Advantages	Disadvantages
PVC	*Lightweight, readily available *Lower cost than Teflon or stainless steel *Good resistance to mineral or oxidizing acids & alkalies	*Weaker, less rigid, more temperature sensitive than metallic materials *May react & leach constituents from groundwater *Poor resistance to ketones, esters, & aromatic hydrocarbons
Polypropylene	*Lightweight, chemically resistant to mineral acids, alkalies, ketones, alcohols, esters, oils *Fair resistance to oxidizing acids, aliphatic hydrocarbons, & aromatic hydrocarbons *Lower cost than Teflon & stainless steel	*Same as PVC and may leach constituents into groundwater *Poor machinability - cannot be slotted because it melts rather than cuts
Teflon	*Lightweight, high impact strength *Outstanding chemical resistance, insoluble in all organics but few fluorinated solvents	*Low tensile strength & low wear resistance *Expensive relative to other plastics & stainless steel

Kynar	*Greater strength & water resistance than Teflon *Lower cost than Teflon	*Not readily available *Poor resistance to acetone & ketones
Mild Steel	*Strong, rigid, temperature sensitivity not a problem *Low cost, readily available *Lower cost than stainless steel or Teflon	*Heavier than plastics *May react & leach constituents into groundwater *Not as chemically resistant as stainless steel
Stainless Steel	*High strength & temperature range *Resistant to corrosion & oxidation *Readily available *Moderate cost	*Heavier than plastics *May leach chromium in highly acidic water *May be catalyst in some organic reactions *Screens higher cost than plastic

SEALING MATERIALS

Bentonite pellets are commonly used above the filter or gravel pack with a bentonite slurry or cement grout filling the annulus above to within a few feet of the surface. A concrete seal is then placed at the surface which slopes away from the well casing. The final well should be equipped with a vented locking protective cap or cover.

WELL DEVELOPMENT

Hydraulic efficiency is generally not an overriding consideration in monitor well construction as it is with high capacity production water wells. However, development of monitor wells is necessary, especially in low permeability formations, to allow free movement of water into the sampling areas. The development process for monitor wells is best accomplished by causing the natural formation water inside the screened or perforated area to move vigorously in and out in order to agitate and remove silt, clay, and fines. The use of water other than natural formation water is not recommended as results of sampling may become altered.

Several suitable methods for developing monitor wells include using a surge block or bailer or surging by pumping or air lift.

SUMMARY

These guidelines and recommended practices dealing with the installation of monitor wells are not meant to represent a complete authority. There are several excellent sources of information available concerning monitor well installations and requirements. One additional recommended information source is the EPA's Resource Conservation & Recovery Act (RCRA) Ground Water Monitoring Enforcement & Compliance Document available from EPA's regional office in Denver, Colorado or the National Water Well Association's Publication Department.

APPENDIX II

RECOMMENDATIONS FOR WATER WELL SYSTEM DISINFECTION

A new well or one that has been repaired or modified should be assumed to be contaminated. This contamination must be removed prior to placing the well into use to protect the health of those who may use the well. The entire well system, casing, pumps, distribution system, etc., must be disinfected.

Well cleaning is a necessary part of well construction. Grease, oil, soil, and other foreign substances can harbor and protect bacteria from subsequent disinfection. Generally mechanical extraction, swabbing, and pumping have proven effective for cleaning most wells in most situations.

After the well has been cleaned, the two most important factors in disinfecting a well system are the concentration of the disinfectant and the duration of the contact of the disinfectant with any contaminated surface. Generally, the stronger the disinfectant solution is, the shorter the contact can be.

Any and all parts of the water well system may be contaminated. Therefore, all parts of the system must be exposed to the disinfectant solution for a sufficient amount of time to insure that the contamination has been neutralized.

Below is one method of disinfecting a water well system.

1. The well system should be completely assembled and in a fully operable condition.

2. Run the system to waste long enough to remove all stagnant or cloudy water. All taps should be opened to flush out the plumbing system. Turn off the pump.

3. Introduce the concentrated solution directly into the well. Some scheme must be used to insure uniform vertical distribution below the water level. Dry chemicals shall be placed in a mechanical carrier and slowly raised and lowered from the bottom of the well to the static water surface until the chemical has dissolved. Liquids or dry chemicals mixed with water to form a concentrated liquid shall be introduced by use of a hose or pipe from the bottom of the well to the static water surface.

4. Circulate the water with the disinfectant in it throughout the well system. Most of the flow should be returned to the well for recirculation. When returning water to the well, the flow should be directed to the well casing so as to completely wet that portion above the static water level. Make certain that water containing the disinfectant has been introduced throughout the system including all pipelines, storage tanks and taps.

5. All taps should be closed and the pump turned off. The disinfectant should be allowed to remain in the system as long as practical, at least 8 hours is recommended.

6. After the disinfectant solution has been in the system at least 8 hours, the water and disinfectant can be pumped to waste.

If the well has a proper surface seal and any polluted groundwater has been sealed out, the system should remain sanitary until it is repaired or otherwise disturbed. A laboratory can analyze a water sample taken at this time to determine if dangerous levels of contamination still exist.

Table 3 gives the amount of hypercholrite needed to disinfect wells of various diameters.

NOTE: Further information on disinfecting wells is available in AWWA specification A-100, AWWA Standard for Deep Wells.

APPENDIX III

SELECTED WATER LAWS OF UTAH
DEALING WITH GROUNDWATER AND APPROPRIATION

Utah Code Annotated 1953, Title 73,
Selected Sections

Sections 73-3-22 to 73-3-26 inclusive, Utah Code Annotated, 1953, have been amended by House Bill 1 1987 (Statutes are effective April 27, 1987) to read as follows:

73-3-22 WELL DRILLER REPORTS

(1) Any person constructing a well or tunnel for the purpose of utilizing or monitoring underground waters shall,within 30 days after the completion or abandonment of the construction, report to the state engineer data relating to each well or tunnel. The report shall be made on forms furnished by the state engineer and shall contain information required by the state engineer.
(2) Any person who fails to comply with the provisions of this section is guilty of a class B misdemeanor.

73-3-23 DEFINITIONS

As used in this chapter:
(1) "Well" means an excavation or opening into the ground made by digging, boring, drilling, jetting, or driving or any other artificial method for utilizing or monitoring underground waters.
(2) "Well driller" means any person that constructs a well for compensation or otherwise.
(3) "Well drilling" means the act of constructing, repiring, or deepening a well, including all incidental work.

73-3-25 LICENSE AND BONDING REQUIREMENTS

(1) Every person that constructs a well in the state shall obtain a license from the state engineer. The application for a license shall be in a form prescribed by the state engineer. All well driller's licenses expire on the 31st day of December following their issuance and are not transferable. The state engineer is authorized and directed to prepare and keep on file in his office rules for well construction.
(2)(a) No person may construct a well in this state without first obtaining a license as provided in this section. No well driller's license will be issued without the applicant filing a $5000.00 penal bond with the state engineer. The bond shall be made payable to the Office of the State Engineer. Proper compliance with the provisions of this section are required to obtain or renew a license.
(b) Well drillers are required to comply with the rules promulgated by the state engineer under this chapter. If the state engineer determines, following an investigation and a hearing upon

at least ten days' notice to the licensee, by registered mail, that the licensee has failed to comply with these rules, the state engineer may revoke or suspend the license, and exact the bond and deposit the money in a nonlapsing dedicated credit. The state engineer may expend the funds to investigate or correct any deficiencies which could adversely affect the public interest resulting from noncompliance with the rules promulgated under this chapter by any well driller. The state engineer may refuse to issue a license to a well driller if it appears that there has been a violation of the rules or a failure to comply with Section 73-3-22.

(c) An order of the state engineer suspending, revoking, or refusing to issue a license is final unless an action to review his decision is filed within the time and in the manner provided by Section 73-3-14.

73-3-26 VIOLATION AND PENALTIES

(1) Any person that does any of the following is guilty of a Class B misdemeanor:
   (a) Constructs a well without first obtaining a license as required by this chapter;
   (b) Advertises to be a well driller without first obtaining a license as required by this chapter;
   (c) Constructs a well after suspension, revocation or expiration of his license;
   (d) Constructs a well in violation of the rules promulgated under Subsection 73-3-25 (1);
(2) Each day of failure to comply with the provisions of this section constitutes a separate offense.

73-1-1 WATERS DECLARED PROPERTY OF PUBLIC

All waters in this state, whether above or under the ground are hereby declared to be the property of the public, subject to all existing rights to the use thereof.

73-1-2 UNIT OF MEASUREMENT - OF FLOW - OF VOLUME

The standard unit of measurement of the flow of water shall be the discharge of one cubic foot per second of time, which shall be known as a second foot; and the standard unit of measurement of the volume of water shall be the acre foot, being the amount of water upon an acre covered one foot deep, equivalent to 43,560 cubic feet.

73-1-3 BENEFICIAL USE BASIS OF RIGHT TO USE

Beneficial use shall be the basis, the measure and the limit of all rights to the use of water in this state.

73-3-1 APPROPRIATION - MANNER OF ACQUIRING WATER RIGHTS

Rights to the use of the unappropriated public waters in this state may be acquired only as provided in this title. No appropriation of water may be made and no rights to the use thereof initiated and

no notice of intent to appropriate shall be recognized except application for such appropriation first be made to the state engineer in the manner hereinafter provided, and not otherwise. The appropriation must be for some useful and beneficial purpose, and, as between appropriators, the one first in time shall be first in rights; provided, that when a use designated by an application to appropriate any of the unappropriated waters of the state would materially interfere with a more beneficial use of such water, the application shall be dealt with as provided in section 73-3-8. No right to the use of water either appropriated or unappropriated can be acquired by adverse use or adverse possession.

73-3-2 APPLICATION FOR RIGHT TO USE UNAPPROPRIATED PUBLIC WATER NECESSITY - FORM - CONTENTS - VALIDATION OF PRIOR APPLICATIONS BY STATE OF UNITED STATES OR OFFICER OR AGENCY THEREOF

Any person who is a citizen of the United States, or who has filed his declaration of intention to become such as required by the naturalization laws, or any association of such citizens or declarants, or any corporation, or the state of Utah by the directors of the divisions of travel development, industrial promotion, fish and game, and state lands or the chairman of the state road commission for the use and benefit of the public, or the United States of America, in order hereafter to acquire the right to the use of any unappropriated public water in this state shall, before commencing the construction, enlargement, extension or structural alteration of any ditch, canal, well, tunnel or other distributing works, or performing similar work tending to acquire such rights or appropriation, or enlargement of an existing right or appropriation, make an application in writing to the state engineer. Such application shall be upon a blank to be furnished by the state engineer, and shall set forth the name and post-office address of the person, corporation or association making the application; the nature of the proposed use for which the appropriation is intended; the quantity of water in acre-feet or the flow of water in second-feet to be appropriated, and the time during which it is to be used each year; the name of the stream or other source from which the water is to be diverted; the place on such stream or source where the water is to be diverted and the nature of the diverting works; the dimensions, grade, shape and nature of the proposed diverting channel; and such other facts as will clearly define the full purpose of the proposed appropriation. If the proposed use is for irrigation, the application shall show the legal subdivisions of the land proposed to be irrigated, with the total acreage thereof and the character of the soil. If the proposed use is for developing power, the application shall show the number, size and kind of water wheels to be employed and the head under which each wheel is to be operated; the amount of power to be produced and the purposes for which and the place where it is to be used; also the point where the water is to be returned to the natural stream or source. If the proposed use is for milling or mining, the application shall show the name of the mill and its location or the name of the mine and the mining district in which it is situated, its nature, and the place where the water is to be returned to the natural stream or source. The point of diversion

and the point of return of the water shall be designated with reference to the United States land survey corners, mineral monuments, or permanent federal triangulation or traverse monuments, when either the point of diversion or the point of return is situated within six miles of such corners and monuments. If the point of diversion or point of return is located in unsurveyed territory, such point may be designated with reference to a permanent, prominent natural object. The storage of water by means of a reservoir shall be regarded as a diversion, and the point of diversion in such cases shall be the point where the longitudinal axis of the dam crosses the center of the stream bed. *The point where released storage water is taken from the stream* shall be designated as the point of rediversion. The lands to be inundated by any reservoir shall be described as nearly as may be, and by government subdivision, if upon surveyed land, the height of the dam, the capacity of the reservoir, and the area of the surface thereof when the reservoir is filled shall be given. If the water is to be stored in an underground area or basin, the applicant shall designate, with reference to the nearest United States land survey corner if situated within six miles thereof, the point of area of intake, the location of such underground area or basin and the points of collection therefrom.

Applications for the appropriation of water filed prior to the enactment thereof, by the United States of America, or any officer or agency thereof, or the state of Utah, or any officer or agency thereof, are validated, subject to any action thereon by the state engineer.

73-3-3 CHANGE OF PLACE OF DIVERSION OR USE RIGHT TO - PERMANENT OR TEMPORARY - APPLICATION - CONTENTS - INVESTIGATION - NOTICE AND HEARING - DEPOSIT TO COVER EXPENSES - FINALITY OF DECISION - *VIOLATION AS MISDEMEANOR - EXCEPTION AS TO REPLACEMENT WELLS*

Any person entitled to the use of water may change the place of diversion or use and may use the water for other purposes than those for which it was originally appropriated, but no such change shall be made if it impairs any vested right without just compensation. Such changes may be permanent or temporary. Changes for an indefinite length of time with any intention to relinquish the original point of diversion, place or purpose of use are defined as permanent changes. Temporary changes include and are limited to all changes for definitely fixed periods of not exceeding one year. Both permanent and temporary changes of point of diversion, place or purpose of use of water including water involved in general adjudication or other suits, shall be made in the manner provided herein and not otherwise.

No permanent change shall be made except on the approval of an application therefor by the state engineer. Such applications shall be made upon blanks to be furnished by the state engineer and shall set forth the name of the applicant, the quantity of water involved, the stream or source from which the appropriation has been made, the point on the stream or source where the water is diverted, the point to which it is proposed to change the diversion

of the water, the place, purpose and extent of the present use, and the place, purpose and extent of the proposed use and such other information as the state engineer may require. The procedure in the state engineer's office and rights and duties of the applicants with respect to applications for permanent changes of point of diversion, place or purpose of use shall be the same as provided in this title for applications to appropriate water; but the state engineer may, in connection with applications for permanent change involving only a change in point of diversion of 660 feet or less, waive the necessity for publishing notice of such applications. No temporary change shall be made except upon an application filed in duplicate with the state engineer upon forms to be provided by him, which shall set forth the name of the water user, a description of his water right, the nature and time of the change sought, the reason for the change, and such other information as the state engineer may require. The state engineer shall make an investigation, and if such temporary change does not impair any vested rights of others, he shall make an order authorizing the change. If he shall find that the change sought might impair such rights, he shall give notice of the application to all persons whose rights may be affected thereby and shall give them an opportunity to be heard before authorizing the change. Such notice may be given by regular mail five days before the hearing or by one publication in a newspaper of general circulation in the county in which the original point of diversion or place of use is located five days before such hearing. Before making an investigation or giving notice the state engineer may require the applicant to deposit a sum of money sufficient to pay the expenses thereof.

Applications for either permanent or temporary changes shall not be rejected for the sole reason that such change would impair vested right of others, but if otherwise proper, they may be approved as to part of the water involved or upon condition that such conflicting rights be acquired.

Any person holding an approved application for the appropriation of water may in like manner, either permanently or temporarily change the point of diversion, place or purpose of use, but no such change of approved application shall affect the priority of the original application; provided, that no change of point of diversion, place or nature of use set forth in an approved application shall operate to enlarge the time within which the construction of work shall begin or be completed. The determination of the state engineer shall be final, unless an action to review his decision is filed within the time and in the manner provided by section 73-3-14.

Any person who changes or who attempts to change a point of diversion, place or purpose of use, either permanently or temporarily without first applying to the state engineer in the manner herein provided, shall obtain no right thereby and shall be guilty of a misdemeanor, each day of such unlawful change constituting a separate offense, separately punishable.

The provisions of this section shall not apply to the replacement of an existing well by a new well drilled within a radius of 150

feet from the point of diversion from said existing well, and no such replacement well shall be drilled except upon compliance with the requirements of section 73-3-28.

73-3-5.5 TEMPORARY APPLICATIONS TO APPROPRIATE WATER - APPROVAL BY ENGINEER - NOTICE AND HEARING - EXPIRATION - PROOF OF APPROPRIATION NOT REQUIRED

1) The state engineer may issue temporary applications to appropriate water for beneficial purposes. The provisions of this chapter governing regular applications to appropriate water shall apply to temporary applications with the following exceptions:

a) The state engineer shall undertake a thorough investigation of the proposed appropriation, and if such temporary application complies with the provisions of section 73-3-8, may make an order approving the application. If the state engineer shall find that the appropriation sought might impair other rights, the state engineer shall give notice of the application to all persons whose rights may be affected thereby and shall give them an opportunity to be heard before approving the application. The notice may be given by regular mail five days before the hearing or by one publication in a newspaper of general circulation in the county in which the point of diversion is located.
b) The state engineer may issue a temporary application for a period of time not exceeding one year.
c) The state engineer, in the approval of a temporary application, may make approval subject to such conditions and provisions as the state engineer deems necessary to fully protect prior existing rights. If, in the judgment of the state engineer, it is necessary to have a water commissioner distribute the water under a temporary application for the protection of other vested rights, the state engineer may assess the distribution costs against the holder of the temporary application.
d) A temporary application does not vest in its holder a permanent vested right to the use of water, and a temporary application automatically expires and is cancelled in accordance with its terms.
e) Proof of appropriation required under this chapter shall not apply to temporary applications.

73-3-8 APPROVAL OR REJECTION OF APPLICATION - REQUIREMENTS FOR APPROVAL - APPLICATION FOR SPECIFIED PERIOD OF TIME - FILING OF ROYALTY CONTRACT FOR REMOVAL OF SALT OR MINERALS

1)It shall be the duty of the state engineer to approve an application if: (a) there is unappropriated water in the proposed source; (b) the proposed use will not impair existing rights or interfere with the more beneficial use of the water; (c) the proposed plan is physically and economically feasible, unless the application is filed by the United States Bureau of Reclamation, and would not prove detrimental to the public welfare; (d) the applicant has the financial ability to complete the proposed works; and (e) the application was filed in good faith and not for purposes of speculation or monopoly. If the state engineer,

because of information in his possession obtained either by his own investigation or otherwise, has reason to believe that an application to appropriate water will interfere with its more beneficial use for irrigation, domestic or culinary, stock watering, power or mining development or manufacturing, or will unreasonably affect public recreation or the natural stream environment, or will prove detrimental to the public welfare, it is his duty to withhold his approval or rejection of the application until he has investigated the matter. If an application does not meet the requirements of this section, it shall be rejected.

2) An application to appropriate water for industrial, power, mining development, manufacturing purposes, agriculture, or municipal purposes may be approved for a specific and certain period from the time the water is placed to beneficial use under the application, but in no event may an application be granted for a period of time less than that ordinarily needed to satisfy the essential and primary purpose of the application or until the water is no longer available as determined by the state engineer. At the expiration of the period fixed by the state engineer the water shall revert to the public and is subject to appropriation as provided by Title 73. The state engineer may extend any limited water right upon a showing that the essential purpose of the original application has not been satisfied, that the need for an extension is not the result of any default or neglect by the applicant, and that water is still available; except no extension shall exceed the time necessary to satisfy the primary purpose of the original application. A request for extension must be filed in writing in the office of the state engineer not later than 60 days before the expiration date of the application.

3) Before the approval of any application for the appropriation of water from navigable lakes or streams of the state which contemplates the recovery of salts and other minerals therefrom by precipitation or otherwise, the applicant shall file with the state engineer a copy of a contract for the payment of royalties to the state of Utah. The approval of an application shall be revoked in the event of the failure of the applicant to comply with terms of his royalty contract.

73-3-23 REPLACEMENT OF WATER

In all cases of appropriation of underground water the right of replacement is hereby granted to any junior appropriator whose appropriation may diminish the quanity or injuriously affect the quality of appropriated underground water in which the right to the use thereof has been established as provided by law. No replacement may be made until application in writing has been made to and approved by the state engineer. In all cases replacement shall be at the sole cost and expense of the application and subject to such as the state engineer may prescribe. The right of eminent domain is hereby granted to any applicant for the purpose of replacement as provided herein.

73-3-27 REQUESTS FOR SEGREGATION OF PENDING APPLICATIONS

Upon request in writing and approval by the state engineer, applications to appropriate or to permanently change the point of diversion, place or purpose of use of water may be divided or segregated into two or more separate parts; provided such request shall be made upon blanks to be furnished by the state engineer and shall include the serial number of the application to be segregated, the name, post-office address of the owner of the application, a statement of the nature of the proposed division or segregation, the reasons therefor, and such other information as the state engineer may require.

Action taken by the state engineer on applications for appropriation or permanent change prior to segregation, shall be applicable in all respects to the segregated parts thereof. Upon segregation the original and each segregated part shall be treated as separate applications. The approval of a request for segregation shall not confirm the validity or good standing of the segregated application or extend the time for the construction of works. Action of the state engineer upon requests for segregation taken prior to the effective date of this act is approved and confirmed.

Requests for segregation shall be rejected if the approval thereof would impair rights or would prove detrimental to the public welfare.

73-3-28 REPLACEMENT WELLS - DEFINITION OF - REQUIREMENTS - STATE ENGINEER'S APPROVAL - APPLICATION TO DRILL - FILING - FORM - CONTENTS - NOTICE - FEES - PLUGGING OF OLD WELL

An existing well may be replaced with a replacement well within a radius of 150 feet from the existing well without the filing of a change application under section 73-3-3, upon approval first having been obtained from the state engineer.

Such request for permission to drill a replacement well shall be filed with the state engineer upon a blank to be furnished by the state engineer. Such blank shall contain, but need not be limited to, the name and postoffice address of the person, corporation or association making the request, the number of the claim or application filed with the state engineer covering the well which is being replaced, the number of the award if, in a decree, the reason for the replacement, the location of the replacement well with reference to the nearest United States land survey corner, and from the old well, and the name of the driller employed by the applicant to do the work.

No filing fee shall be required for the filing of such a request for permission to drill a replacement well, and the state engineer need give only such notice as, in his judgment, is necessary to protect existing rights, and in the event the state engineer shall

determine that it is necessary to publish notice, the advertising fee shall be paid in advance by the applicant.

The term "replacement well" as used herein means a new well drilled for the sole purpose of replacing an existing well which is impaired or made useless by structural difficulties and no new right in the use of water accrues. Upon completion of the new well the old well must be plugged by the applicant in a manner satisfactory to the state engineer.

73-5-9 POWERS OF STATE ENGINEER AS TO WASTE, POLLUTION OR CONTAMINATION OF WATERS

To prevent waste, loss, pollution or contamination of any waters whether above or below the ground, the state engineer may require the repair or construction of head gates or other devices on ditches or canals, and the repair or installation of caps, valves or casings on any well or tunnel or the plugging or filling thereof to accomplish the purposes of this section.

Any requirement made by the state engineer in accordance with this section shall be executed by and at the cost and expense of the owner, lessee or person having control of such diverting works affected. If within 10 days after notice of such requirement as provided in this section, the owner, lessee or person having control of the water affected, has not commenced to carry out such requirement, or if he has commenced to comply therewith but shall not thereafter proceed diligently to complete the work, the state engineer may forbid the use of water from such source until the user thereof shall comply with such requirement. Failure to comply with any requirement made by the state engineer in accordance with the provisions of this section shall constitute a misdemeanor. Each day that such violation is permitted to continue shall constitute a separate offense.